"Operational Analysis of Crime Information Using GIS"

A synopsis Submitted to

Swami Ramanand Teerth Marathwada University, Nanded

School of Computational Sciences

By

Mr. Vijendra Prabhakarrao Kamble
(Research Scholar)

Under the Guidance of

Dr. Nilesh K. Deshmukh
M.Sc. PhD
Assistant Professor
School of Computational Sciences,
S. R. T. M. University, Nanded, Maharashtra.

“Operational analysis of crime information using GIS”

1. Introduction

The growing number of applications of the available GIS data is in turn feeding the appetite for new and improved technologies. This field of geographical information system (GIS) has seen remarkable development over recent time owing to the increasing quality

of prevention of crime and the increasing work on operational method by several countries around the world. While geographical information system (GIS) made enormous progress over the last three decades in terms of better analysis of crime on the basic of geographical information system.

In [1] writer discovers that One of the first applications of spatial analysis in epidemiology is in 1832. In [2] author represents that In 1854 John Snow depicted a cholera outbreak in London using points to representation the locations of some individual’s cases, possibly the earliest use of a geographic methodology in epidemiology. in [3] By the end of the 20th century, the rapid growth in various systems had been consolidated and standardized on relatively few platforms and users were beginning to explore viewing GIS data over the Internet, requiring data format and transfer standards. More recently, a growing number of free, open source GIS packages run on a range of operating systems and can be customized to perform specific tasks. Increasingly geospatial data and mapping application are being made available via the World Wide Web.

Geographic Information System (GIS) uses geography and computer-generated maps as an interface for integrating and accessing massive amounts of location-based information. GIS allows police personnel to plan effectively for emergency response, analysis historical events, and predict future events. In [4] author focused on GIS can also be used to get critical information to

emergency responders upon GIS helps identify potential suspects to increase investigators suspect base when no leads are evident.

Data-mining for crime analysis:

This technique makes the system easier to use, allows uncomplicated data handling and supports many different data types. Consequently, data preparation becomes easier and results contain more information. A number of Dutch police forces have already been using this system for several years with over 30 users. Since the analytical process within the police is very knowledge-intensive, a high level of domain expertise is essential, which makes it harder to find a police data miner with sufficient domain knowledge plus technical skills in the area of databases, statistics and data mining.

1.1 Motivation

In developed countries, police department rely heavily on geographic information systems. But, in developing countries, the trivial tools like paper maps, crime record which our predecessors have used for centuries are still considered as foremost valid. While there is a certain comfort from having a record system containing large numbers of papers with crime data marked on them, such systems have serious disadvantages and hidden costs. But, the increasing burden of work on police personnel's will be reduces by using technology like GIS (geographical information system).

Many of the reports about wellbeing and personal life have underlined several threats due to over burden of work. Police department faces the similar problems. It is clear perception of me that application of technology will enable the police personals working smartly with keeping personal life very well. This idea motivated me to study about Operational analysis of crime information.

2. Statement of Problem

It is purposed to minimize the human intervention in the detection process and produce accurate results by using the information of automatic roads maps, boundaries of police station, demographic features and hotspots. Also it may be applicable in the assigning the duties, simulated training and maintenance of law and order in the city.

Many approaches have contributed fundamental concepts and analysis methods to the enhancement of roads maps, boundaries of police station, man power arrangement, hotspot detection and reconstruction. Despite extensive research in analysis of crime, however, the problem is still unsolved, at least as far as general and robust methods are concerned. One reason for this situation is that analysis have a wide variety of types depending on their purpose, culture, regions and countries. The problem of statement of this research presents a predefined model that offers a solution to the problem of Operational analysis of crime using GIS.

Literature Review

A number of studies are conducted in the field of GIS. These studies show wide applications of GIS in diversified walks of life. Also, they were helpful in the understanding of selection of problem, selection of plan and methodology etc. Few of them which are more relevant to the proposed problem are presented here in brief.

In (5) the author specifies three policies which have positive effect on reduction of criminal activity 1. Education policies-In this model it simulates annually improvement in education. 2. Increase the number of policemen- it will affect on criminality. 3. Improvement of sectors environment- this type of model suggest that lightening on street develop the slum area and so on.

In (6) the author highlighted that the problem that exited within communication when new system were introduced. In this paper the author

has introduced the concept of linking SSM (soft system methodology) and VSM (visible system model). As per the author experience applying an information system thinking approach has enhanced the provision of information.

In (7) the author introduces significance of using GIS and data mining technique. It can be effectively work for the police analysis system can give instruction quickly to police when accident taken place. By the use of this technique police department can response much more quickly to deal with emergency.

In (8) author analyzing the data series from 1978 to 2003 and he uses Markov Chain model to design a police intelligence analysis system.

In (9) as per the writer study using spatial analysis tools they made an investigation about burglary and robbery patterns in Beijing. He used KDE method for hotspot detection. He observes that the transportation hub and shopping center had higher crime risk and for that he is working.

In (10) author present a system to policemen to track safety for public for this work he design geo-database from small station he used Arc GIS V10 with network analyst and spatial analyst extension use real time traffic density data instead of the assumed data.

In (11) the research focuses on the novel use of the concept of boundaries or edges to analyze micro level deference in crime in various urban neighborhoods. The author suggested different way to support the crime pattern theory. 1) Crime events are complex as these relates to urban dynamics. 2) Crime events explore here are not uniformly distributed in the edges. Some edges have significantly higher level of crime. 3) The variation in crime distribution may be attributed to the movement patterns within these edges.

In (12) author developed a crime simulation system that generates incident level crime data and support query based crime analysis on GIS map. By the help of this system the system provides incident level data which is hard in practice.

3. Research Outline

The research question, aims, objectives, scope, significance, limitations and justification are defined in this section.

3.1. Research Question

The research question examined by this thesis is:

- "*Is predefined model capable to operational analysis of the crime information?"*

It hypothesized that an improvement in Operational analysis of crime information could be achieved through integrating recent advances in roads maps, boundaries of police station, man power arrangement, hotspot detection.

3.2. Aim

The aim of this research is to develop new generic framework (model) having temporal and spatial crime data available on-time to aid analysis and to assist both experts and non-experts users.

3.3. Objectives

The objectives of the study are as following:

- To plot the crimes and analyze the Crime patterns.
- To develop spatial and statistical queries and analysis tool.
- To develop the tools analyzing crime in accordance of demographic features
- Mapping crime according to time-of-day and day-of-week per CAS block

- Generating mosaics of CAS block according to magnitude of the given crime
- Identifying and locating hotspot.

Objective will change as per data available.

3.4. Significance

This research proposes a novel model that has a solid foundation in Operational analysis of crime information.

The major contribution of this research can be summarized as:

- It is applicable in defining Crime pattern analysis of plotted crimes.
- It is able to develop spatial and statistical queries and analysis tool.
- It is able to analyze crime in accordance of demographic features
- It is able to mapping the types of crime per crime administration system (CAS) block1.
- Its ability to mapping crime according to time-of-day and day-of-week per CAS block.
- Its ability to generating mosaics of CAS block according to magnitude of the given crime.
- It is able to identify and locate hotspot
- These new techniques will require minimal architectural changes or modification to the existing framework. Also, it will be beneficial to Police personals to perform duties smoothly in the office and personal life.

4. Research Methodology

The Development research approach is applied in response to answer the research problem. The flow chart of the procedure for proposed study is as depicted in figure 1

The methodology applied for development of GIS for operational analysis of crime will be validated through the analysis of actual data of crime gathered from police stations in Nanded city. The results from overall stage lead to minor refinements of the original theoretical framework and also provide new research question for future work. This research is a case study of analysis of crime in Nanded city from aerial photographs of city block areas, Roads maps, boundaries of police station, demographic features etc.

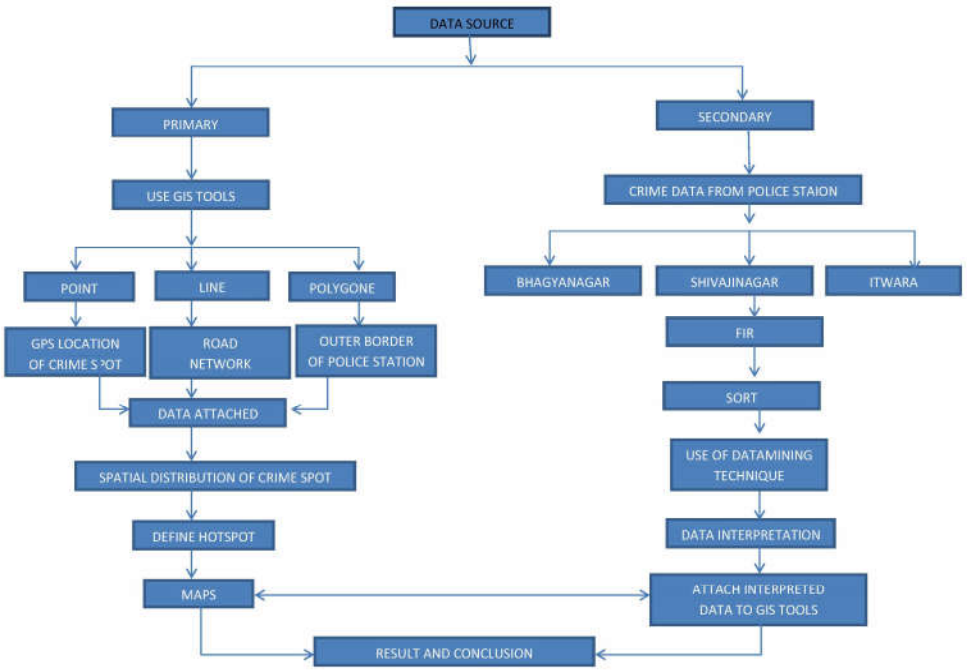

Fig. 1: Methodology for analysis of crime.

Chapter Scheme:

The thesis will be consist of following chapters

Chapter I: Introduction

It will provide the conceptual framework, background of the study with Aim & objectives, limitations, significance etc.

Chapter II: Review of Related Literature

The review of previous researches will be given to comprehend the originality & need of the present study.

Chapter III: Experimental design & method

It will provide the rational of the plan and procedures followed by the researcher for development of GIS regarding the problem of study.

Chapter IV: Data Analysis and presentation

The data gathered for the purpose of experiment will be analyzed by using various Geo- statistical tools and will be presented in the form of tables, layouts & graphs etc.

Chapter V: Results & Discussion

The results of the study will be presented and discussed in this chapter.

Bibliography and appendices will be included in the reference section of thesis.

References

1. Seine, "*Rapport sur la marche et les effets du choléra-morbus dans Paris et les communes rurales du département de la Seine: année 1832*", http://gallica.bnf.fr/ark:/12148/bpt6k842918/f353.image, Retrieved on 20/02/2014.

2. John Snow, "*John Snow's Cholera Map*", Yor University, http://www.york.ac.uk/depts/maths/histstat/snow_map.htm, Retrieved on 30-03-2014

3. Fu, P., and J. Sun, "*Web GIS: Principles and Applications*" ESRI Press Redlands, CA.s ISBN 1-58984-245-X, 2010.

4. C.P. Johnson, "*Crime Mapping and Analysis Using GIS*", Geomatics 2000: Conference on Geomatics in Electronic Governance, Pune, January 2000.

5. Sergio E. Quijada, Juan F. Arcas, Cristian Renner, "*A SPATIO TEMPORAL SIMULATION MODEL FOR EVALUATING DELINQUENCY AND CRIME POLICIES" Proceedings of the 2005 Winter Simulation Conference*

6. Peter Kinloch, Hulya Francis, Michael Francis, Mark Taylor, "Police Operational Planning and Crime Detection through Adopting an Information Systems Approach" 978-1-4244-3397-1/08/ ©2008 IEEE

7. FAN Wen-you, CHEN YE, "Design and study on police intelligence analysis system based on GIS." 978-1-4244-4507-3/09/©2009 IEEE

8. Yufei Zhang, Huifeng Ji, "Using GIS to Analyze and Forecast the ChineseCrime Rate." 978-1-4244- 7618-3 /10/©2010 IEEE

9. Peng Chen, Tao Chen, Hongyong Yuan, "GIS Based Crime Risk Analysis and Management in Cities." 978-1-4244- 7618-3 /10/ ©2010 IEEE

10. Eman Mohamed Abd El-Aziz, Saleh Mesbah, Khaled Mahar, "GIS-Based Decision Support System for Criminal Tracking." 978-1-4673-2824-1/12/©2012 IEEE

11. Justin Song, Valerie Spicer, Patricia Brantingham, "The Edge Effect." 978-1-4673-6213-9/13/©2013 IEEE

12. Mehmet Sait VURAL, Mustafa GÖK, Zeki YETGİN, "Generating Incident-Level Artificial DataUsing GIS Based Crime Simulation." 978-1-4799-3343-3/13/ ©2013 IEEE

Research Guide	**Research Scholar**
Dr. Nilesh K. Deshmukh	Mr. Vijendra P. Kamble